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SUDBURY RIVER BASIN

WATER QUALITY SURVEY

1991

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SUDBURY RIVER BASIN

WATER QUALITY SURVEY

1991

RESOURCE ASSESSMENT PROJECT NUMBER 91-12

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF RESOURCE PROTECTION
OFFICE OF WATERSHED MANAGEMENT
40 INSTITUTE ROAD
NORTH GRAFTON, MASSACHUSETTS

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FOREWORD

The Massachusetts Division of Water Pollution Control was established by the Massachusetts Clean Water Act, Chapter 21 of the General Laws as amended by Chapter 685 of the Acts of 1966. Included in the duties and responsibilities of the Division is the periodic examination of the water quality of various coastal waters, rivers, streams, and ponds of the Commonwealth, as stated in Section 27, Paragraph 5 of the Acts. This section further directs the Division to publish the results of such examination, together with the standards of water quality established for the various waters. The Office of Watershed Management along with the Division of Water Pollution Control's Technical Service Section, has among its responsibilities, the execution of this directive. This report is published under the Authority of the Acts, and is among a continuing series of reports issued by the Division presenting water quality data and analyses, water quality management plans, baseline and intensive limnological studies and special studies.

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INTRODUCTIONS

The Sudbury River originates in the center of an extensive wetland as the outlet of Cedar Swamp Pond in Westborough at river mile 31.0. The river flows easterly through the town of Ashland where it enters and flows through two backup drinking water reservoirs in the town of Framingham. It picks up flow from its north Branch in Reservoir No. 1 near river mile 21. The river flows northeast out of these reservoirs through a very slow moving stretch into the impoundment in the village of Saxonville at river mile 16.3. The Saxonville Dam was built at the head of a series of rock ledges which lead into the rivers final moderate grade segment before it enters another extensive wetland (around river mile 14.5) which continues through its remaining length. The river flows more northerly from this point to its confluence with the Assabet River. This confluence is the source of the Concord River. One of the more important tributaries is Hop Brook which joins Wash Brook and subsequently the Sudbury at river mile 10.9. Wash Brook and Hop Brook are designated under the Massachusetts Surface Water Quality Standards (MA DEP 1990) as Class B waters, suitable for supporting a warm water fishery and for primary and secondary contact recreation (See Figure 1). Minimum water quality criteria, designed to protect the designated uses, are also promulgated in the standards.

METHODS AND RESULTS

This report contains the results of two synoptic water quality surveys of the Sudbury River Basin performed by the MA Division of Water Pollution Control's Technical Services Section (MA DWPC-TSS) during the summer of 1991. Five day antecedent rainfall was .39 inches and .29 inches for the August and September surveys, respectively. Grab samples for select physicochemical parameters were collected at fourteen sampling stations (See Table 1 and Figure 2) along the Sudbury River, Hop Brook, and Wash Brook on August 8, 1991 and September 19, 1991. In addition, dissolved oxygen (DO) and temperature measurements were taken at each station during "runs" which began at 0400 hours, 1000 hours and 1600 hours. Dissolved oxygen samples were collected and "fixed" at each station and were subsequently titrated at the DWPC-TSB laboratory in Westborough using a modification of the Winkler Method (TSB 1989). The temperature was measured at each station with a hand-held dial thermometer. Procedures used for bottle preparation, sampling techniques, and sample handling are outlined in the standard operating procedures (SOP) manual (TSB 1989).

Table 2 contains the temperature and DO data in addition to the percent saturation calculations. Bacteriological and physicochemical sampling including pH, suspended solids, alkalinity, hardness, turbidity, chloride, Total Kjeldahl-nitrogen, ammonia-nitrogen, nitrate-nitrogen, total phosphorus, and total aluminum (Al), silver (Ag), cadmium (Cd), chromium (Cr), Copper (Cu), lead (Pb), manganese (Mn), nickel (Ni), and zinc (Zn) was conducted in addition to the temperature, and dissolved oxygen monitoring. Due to limited laboratory resources, decisions were made with regard to which analyses would be run at a particular station. For instance, all analyses were run at HB91-13 due to its location just downstream of the Marlborough East Wastewater Treatment Plant.

All water quality samples were preserved as necessary, iced, and transported to Wall Experiment Station (WES), the state's water quality laboratory, for analysis. All samples were analyzed according to the American Public Health Association (APHA) approved methods (Greenberg et al., 1985). Data pertaining to quality control procedures are on file at the WES laboratory. The results of the water quality surveys are summarized for each station and contained in Table 2 through 13. Figures 3 through 6 are graphic depictions of mainstem dissolved oxygen and percent saturation data from each day's three runs compared to Class B Water Quality Standards.

Figure 1

1991 Sudbury River Water Quality Survey

River Classification

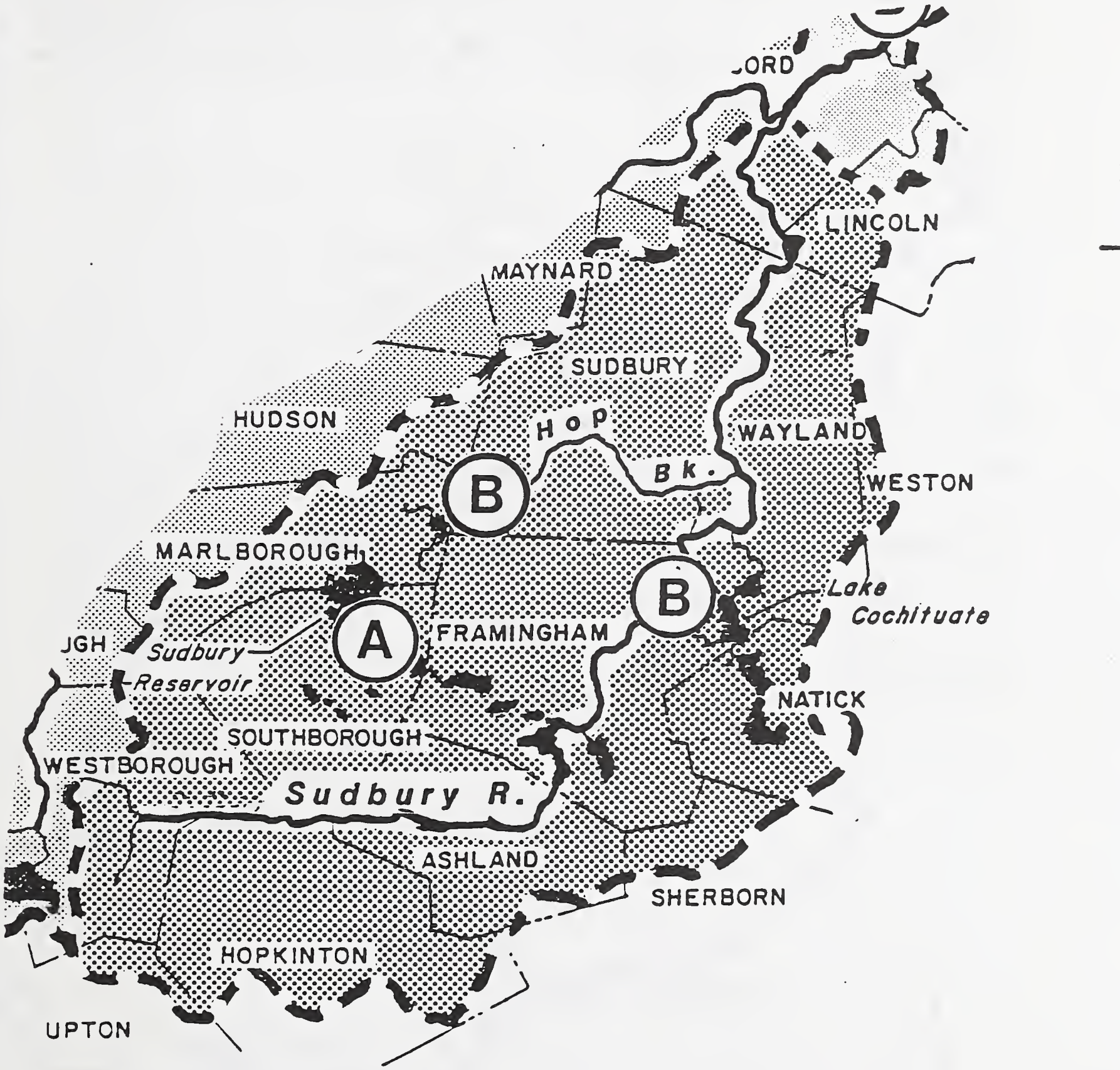


TABLE 1

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Location of Sampling Stations

STATION	LOCATION	RIVER MILE
SR91-1	Sudbury River, Fruit Street, Hopkinton	29.5
SR91-2	Sudbury River, Cordaville Road, Ashland	25.2
SR91-3	Sudbury River, Route 135, Ashland	23.4
SR91-4	Sudbury River, Fountain Street, Framingham	22.4
SR91-5	Sudbury River, Winter Street, Framingham	20.7
SR91-6	Sudbury River, Central Street, Framingham	18.8
SR91-7	Sudbury River, Wickford Street, Framingham	17.4
SR91-8	Sudbury River, Outlet of Impoundment, Saxonville	16.3
SR91-9	Sudbury River, Potter/Stonebridge Road, Wayland/Framingham	14.6
SR91-10	Sudbury River, Route 20, Wayland	10.9
SR91-11	Sudbury River, Route 27, Wayland	9.9
HB91-13	Hop Brook, Route 20, inlet Hagar Pond, Marlborough	8.0
HB91-14	Hop Brook, Route 20, South Sudbury	0.48
WB91-15	Wash Brook, Elm Street, South Sudbury	2.3

Figure 2
1991 Sudbury River Water Quality Survey
Location of Sampling Stations

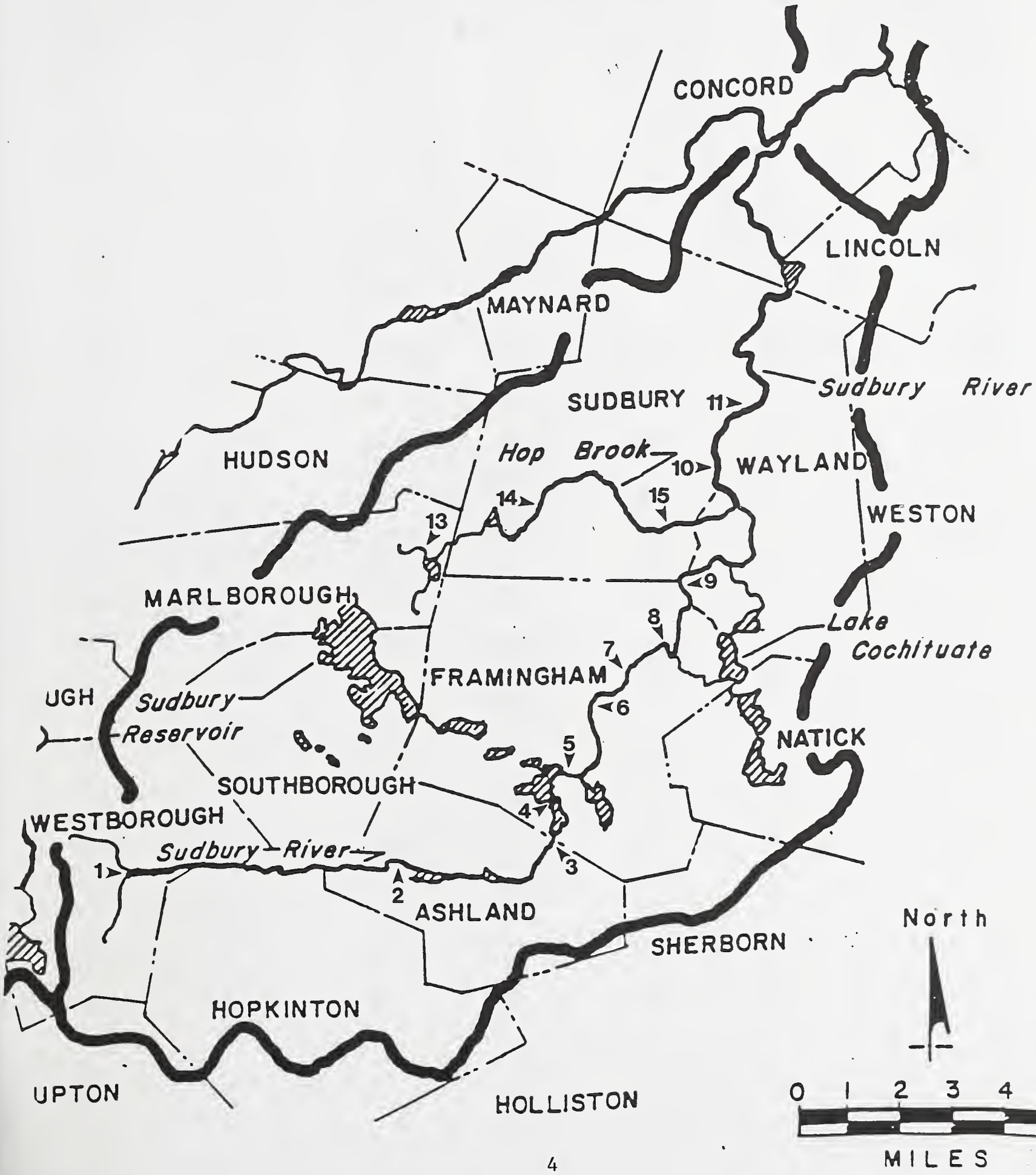


TABLE 2

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Time, Temperature (°C), Dissolved Oxygen (mg/l), % Saturation Data

STATION		8/8/91[1]	8/8/91[2]	8/8/91[3]	9/19/91[1]	9/19/91[2]	9/19/91[3]
SR91-1	*	0450	1034	1630	0400	1000	1600
	**	18	20	24	19.5	20	19
	***	3.7	4.5	5.7	2.2	2.5	2.8
	****	39	50	68	24	28	30
SR91-2		0527	1049	1640	0510	1020	1633
		22	23	25	20	20	19
		7.0	6.7	7.0	6.4	5.3	6.5
		80	78	85	71	58	70
SR91-3		0545	1109	1655	0525	1025	1643
		20	25	28.5	20	20.5	20
		3.9	7.4	8.7	5.9	6.4	6.5
		43	90	111	65	72	72
SR91-4		0605	1120	1700	0540	1040	1652
		25	26	28	21	21	20
		7.2	7.0	7.6	7.0	6.9	6.7
		87	87	97	79	78	74
SR91-5		0615	1129	1710	0545	1045	1658
		25	25	28	22	22	21
		7.8	7.3	7.3	7.5	8.2	7.8
		95	89	93	86	94	88
SR91-6		0624	1140	1620	0555	1100	1710
		24	24	26	20	21	19.5
		5.1	5.8	7.7	5.9	6.3	7.1
		61	69	95	65	71	77
SR91-7		0632	1148	1730	0602	1105	1715
		23	24	27.5	20	21	20
		4.9	6.4	10.0	5.5	6.0	6.4
		57	76	127	61	67	71
SR91-8		0641	1158	1735	0611	1110	1721
		23	25	25.5	22	22	21
		7.6	7.8	7.6	7.7	8.3	8.1
		89	95	93	88	95	91
SR91-9		0650	1207	1745	0625	1120	1728
		23	23	27.0	20	21	19
		6.4	7.6	9.6	6.8	7.9	7.3
		75	83	120	76	89	79
SR91-10		0748	1318	1845	0710	1215	1808
		23	25	26	21	21	20
		6.0	6.8	6.9	6.4	6.6	6.1
		70	83	86	72	74	67

TABLE 2 (Continued)

Time, Temperature (°C), Dissolved Oxygen (mg/l), % Saturation Data

STATION	8/8/91[1]	8/8/91[2]	8/8/91[3]	9/19/91[1]	9/19/91[2]	9/19/91[3]
SR91-11	0800	1333	1900	0724	1230	1817
	24	26	27	20	22	20
	4.8	6.4	7.7	5.6	6.4	6.5
	57	79	97	62	73	72
HB91-13	0711	1235	1815	0641	1145	1749
	20	23	22.5	20	21	19
	6.6	8.1	7.2	6.3	7.8	7.4
	73	95	83	69	88	80
HB91-14	0734	1305	1835	0657	1205	1800
	20	22	24.5	19	20	17
	5.8	8.3	8.5	6.2	7.8	6.2
	60	76	78	59	77	63
WB91-15	0700	1217	1800	0625	1130	1735
	19	23	24.5	19	20	18
	5.6	6.5	6.5	5.5	7.0	6.0
	60	76	78	59	77	63

* Time (h)
** Temperature
*** Dissolved Oxygen
**** % Saturation

[1]0400 Hour Run
[2]1000 Hour Run
[3]1600 Hour Run

TABLE 3

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Field Measurements of pH (Standard Units)

STATION	8/8/91[1]	8/8/91[2]	8/8/91[3]	9/19/91[1]	9/19/91[2]	9/19/91[3]
SR91-1	6.7	6.8	6.9	6.1	6.1	5.8
SR91-2	7.1	6.9	7.2	6.3	6.3	6.1
SR91-3	6.8	7.3	7.8	6.4	6.3	6.0
SR91-4	7.3	7.4	7.5	6.6	6.4	6.2
SR91-5	7.4	7.5	7.4	6.7	6.6	6.5
SR91-6	7.0	7.0	7.2	6.6	6.2	6.2
SR91-7	6.9	7.0	8.5	6.5	6.2	6.2
SR91-8	7.2	7.5	7.6	7.1	6.9	6.7
SR91-9	7.1	7.3	8.0	6.8	6.5	6.5
SR91-10	6.8	7.3	7.3	6.8	6.3	6.3
SR91-11	6.7	7.2	7.3	6.7	6.3	6.5
HB91-13	6.9	7.5	7.4	7.0	6.6	6.6
HB91-14	7.1	7.7	7.7	7.1	6.8	6.4
WB91-15	7.3	7.4	7.5	6.8	6.7	6.4

[1]0400 Hour Run
[2]1000 Hour Run
[3]1600 Hour Run

TABLE 4

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Total Alkalinity Data (mg/l)

STATION	Run (hour)	8/8/91	9/19/91
SR91-1	0400	30	29
SR91-1	1000	30	27
SR91-3	0400	23	30
SR91-3	1000	22	23
SR91-10	0400	30	24
SR91-10	1000	30	30
SR91-11	0400	34	32
SR91-11	1000	34	32
HB91-13	0400	48	47
HB91-13	1000	47	47
HB91-14	0400	66	47
HB91-14	1000	66	46

TABLE 5

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Hardness Data (mg/l $CaCO_3$)

STATION	Run (hour)	8/8/91	9/19/91
SR91-1	0400	36	27
SR91-1	1000	34	27
SR91-3	0400	36	*
SR91-3	1000	*	*
SR91-10	0400	36	36
SR91-10	1000	40	46
SR91-11	0400	41	39
SR91-11	1000	45	39
HB91-13	0400	86	87
HB91-13	1000	106	86
HB91-14	0400	55	61
HB91-14	1000	71	48

*no data provided by laboratory

TABLE 6

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Suspended Solids (mg/l)

STATION	Run (hour)	8/8/91	9/19/91
SR91-1	0400	1.5	2.0
SR91-1	1000	1.5	2.0
SR91-3	0400	2.0	1.5
SR91-3	1000	<1.0	1.0
SR91-10	0400	3.0	5.0
SR91-10	1000	4.0	4.0
SR91-11	0400	6.5	6.0
SR91-11	1000	2.0	3.0
HB91-13	0400	1.0	2.5
HB91-13	1000	2.0	2.0
HB91-14	0400	3.5	3.0
HB91-14	1000	5.0	2.5

TABLE 7

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Total Solids (mg/l)

STATION	Run (hour)	8/8/91	9/19/91
SR91-1	0400	182	182
SR91-1	1000	188	190
SR91-3	0400	130	202
SR91-3	1000	202	198
SR91-10	0400	178	184
SR91-10	1000	180	190
SR91-11	0400	176	188
SR91-11	1000	178	170
HB91-13	0400	400	380
HB91-13	1000	436	444
HB91-14	0400	258	188
HB91-14	1000	286	180

TABLE 8

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Turbidity Data (NTU)

STATION	Run (hour)	8/8/91	9/19/91
SR91-1	0400	1.3	1.7
SR91-1	1000	1.5	1.7
SR91-3	0400	1.7	1.3
SR91-3	1000	1.6	1.5
SR91-10	0400	1.2	1.5
SR91-10	1000	1.2	1.7
SR91-11	0400	2.2	1.9
SR91-11	1000	1.1	1.4
HB91-13	0400	0.9	1.2
HB91-13	1000	0.7	1.0
HB91-14	0400	0.9	1.1
HB91-14	1000	1.0	1.2

TABLE 9

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Chloride Data (mg/l)

STATION	Run (hour)	8/8/91	9/19/91
SR91-1	0400	65	60
SR91-1	1000	67	60
SR91-3	0400	39	63
SR91-3	1000	65	63
SR91-10	0400	54	54
SR91-10	1000	54	54
SR91-11	0400	55	54
SR91-11	1000	54	55
HB91-13	0400	70	61
HB91-13	1000	67	61
HB91-14	0400	49	43
HB91-14	1000	49	43

TABLE 10

SUDBURY RIVER BASIN

1991 WATER QUALITY SURVEY

Nitrogen and Phosphorus Data (mg/l)

		(8/8/91)				(9/19/91)		
STATION	Run (hour)	NH_3-N	NO_3-N	Kjeldahl-N	Total P	NH_3-N	NO_3-N	Total P
SR91-1	0400	0.14	0.7	0.64	0.07	0.11	0.19	0.08
SR91-1	1000	0.08	0.20	0.46	0.07	0.19	0.10	0.07
SR91-10	0400	0.04	0.16	0.44	0.09	0.04	0.29	0.04
SR91-10	1000	0.69	0.80	0.69	0.10	0.08	0.68	0.09
SR91-11	0400	0.10	0.22	0.64	0.13	0.10	0.30	0.05
SR91-11	1000	0.04	0.20	0.59	0.13	0.08	0.28	0.09
HB91-13	0400	0.78	15	0.98	0.47	0.35	13	0.55
HB91-13	1000	0.08	17	1.0	0.55	0.38	18	0.61
HB91-14	0400	0.06	0.74	0.73	0.23	0.12	0.84	0.16
HB91-14	1000	0.05	0.83	0.74	0.34	0.08	0.85	0.15
WB91-15	0400	0.08	0.69	0.64	0.27	0.08	0.80	0.20
WB91-15	1000	1.1	1.9	1.1	0.23	0.02	0.76	0.13

TABLE 11

SUDBURY RIVER BASIN
1991 WATER QUALITY SURVEY

Metals Data (8/8/91)

		Metals Concentrations (mg/l)									
Station	Run	Ag	Al	Cd	Cu	Cr	Fe	Mn	Ni	Pb	Zn
SR91-1	0400	<0.02	<0.05	<0.02	<0.02	<0.03	0.51	0.10	<0.05	<0.05	<0.02
SR91-1	1000	<0.02	<0.05	<0.02	<0.02	0.03	0.75	0.07	<0.05	<0.05	0.07
SR91-3	0400	<0.02	0.06	<0.02	<0.02	<0.03	0.38	0.30	<0.05	<0.05	<0.02
SR91-3	1000	<0.02	<0.05	<0.02	<0.02	<0.03	0.67	0.27	<0.05	<0.05	0.04
SR91-10	0400	<0.02	0.07	<0.02	<0.02	<0.03	0.54	0.24	<0.05	<0.05	<0.02
SR91-10	1000	<0.02	<0.05	<0.02	<0.02	0.04	0.37	0.14	<0.05	<0.05	<0.02
SR91-11	0400	<0.02	0.07	<0.02	<0.02	<0.03	0.50	0.24	<0.05	<0.05	<0.02
SR91-11	1000	<0.02	0.06	<0.02	<0.02	<0.03	0.39	0.21	<0.05	<0.05	<0.02
HB91-13	0400	<0.02	0.05	<0.02	<0.02	<0.03	0.12	0.09	<0.05	<0.05	<0.02
HB91-13	1000	<0.02	0.13	<0.02	<0.02	<0.03	0.12	0.08	<0.05	<0.05	<0.02
HB91-14	0400	<0.02	0.05	<0.02	<0.02	<0.03	0.27	0.15	<0.05	<0.05	<0.02
HB91-14	1000	<0.02	<0.05	<0.02	<0.02	0.03	0.08	0.11	<0.05	<0.05	<0.02

TABLE 12

SUDBURY RIVER BASIN
1991 WATER QUALITY SURVEY

Metals Data (9/19/91)

		Metals Concentrations (mg/l)									
Station	Run	Ag	Al	Cd	Cu	Cr	Fe	Mn	Ni	Pb	Zn
SR91-1	0400	<0.02	<0.05	<0.02	<0.02	<0.02	1.1	0.08	<0.02	<0.05	<0.02
SR91-1	1000	<0.02	<0.05	<0.02	<0.02	<0.02	1.1	0.09	<0.02	<0.05	<0.02
SR91-3	0400	<0.02	0.06	<0.02	<0.02	<0.02	0.75	0.22	<0.02	<0.05	<0.02
SR91-3	1000	<0.02	0.05	<0.02	<0.02	<0.02	0.74	0.19	<0.02	<0.05	<0.02
SR91-10	0400	<0.02	0.09	<0.02	<0.02	0.02	0.55	0.22	<0.02	<0.05	0.07
SR91-10	1000	<0.02	0.05	<0.02	<0.02	<0.02	0.45	0.19	<0.02	<0.05	<0.02
SR91-11	0400	<0.02	0.10	<0.02	<0.02	<0.02	0.62	0.28	<0.02	<0.05	0.02
SR91-11	1000	<0.02	0.05	<0.02	<0.02	<0.02	0.53	0.28	<0.02	<0.05	<0.02
HB91-13	0400	<0.02	0.06	<0.02	<0.02	<0.02	0.47	0.16	<0.02	<0.05	<0.02
HB91-13	1000	<0.02	0.13	<0.02	<0.02	<0.02	0.38	0.10	<0.02	<0.05	<0.02
HB91-14	0400	<0.02	0.07	<0.02	<0.02	<0.02	0.40	0.11	<0.02	<0.05	<0.02
HB91-14	1000	<0.02	<0.05	<0.02	<0.02	<0.02	0.39	0.09	<0.02	<0.05	<0.02

TABLE 13

1991 SUDBURY RIVER BASIN
WATER QUALITY SURVEY

Fecal Coliform Data

Station	Run (hour)	Fecal Coliform (per 100 ml)
SR91-1	0400	160
SR91-1	1000	240
SR91-07	0400	120
SR91-07	1000	60
SR91-10	0400	80
SR91-10	1000	20
SR91-11	0400	40
SR91-11	1000	100
HB91-13	0400	60
HB91-13	1000	40
HB91-14	0400	120
HB91-14	1000	220

Figure 3

1991 Sudbury River Water Quality Survey

Dissolved Oxygen 8/8/91

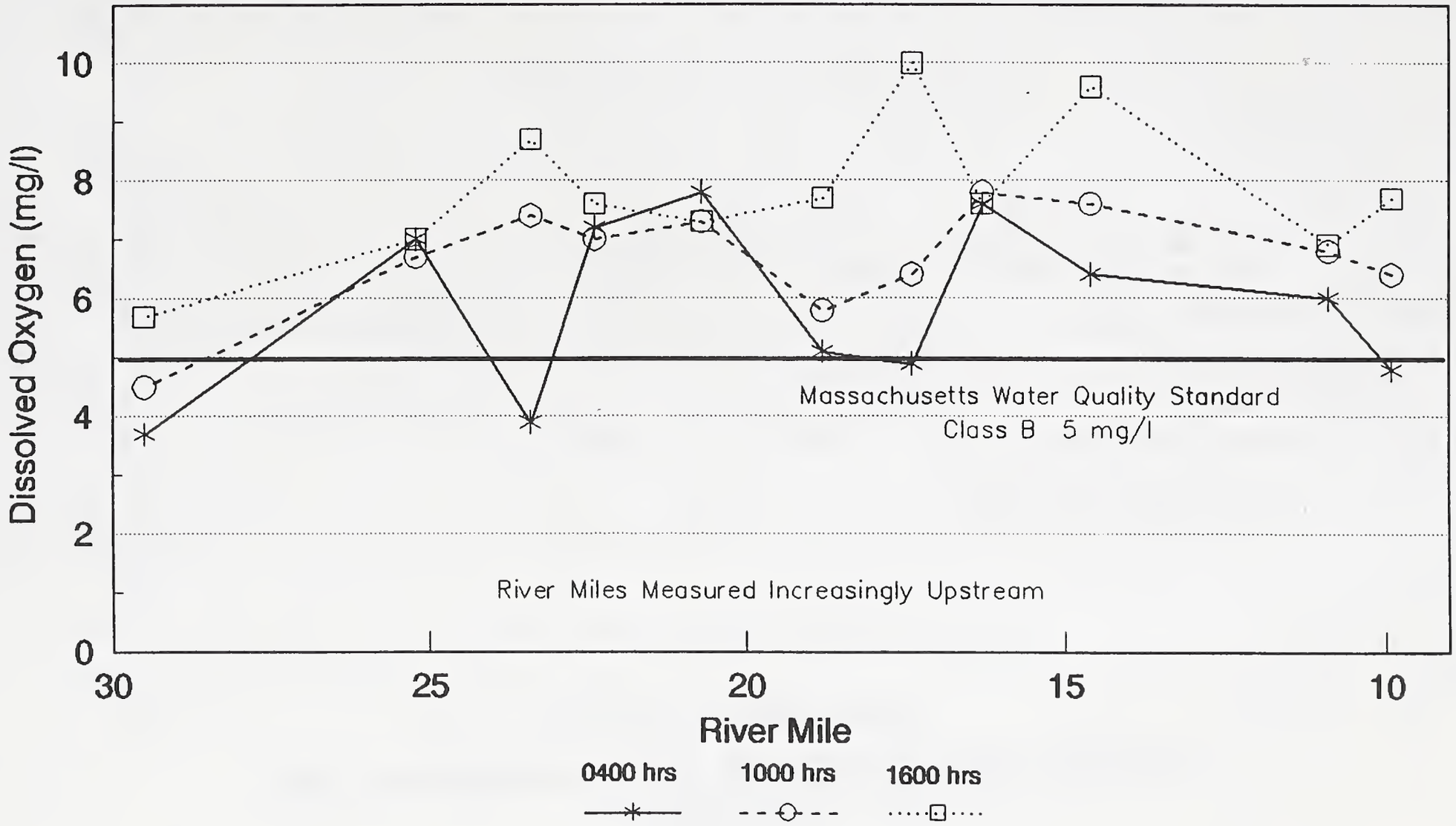


Figure 4

1991 Sudbury River Water Quality Survey

Dissolved Oxygen 9/19/91

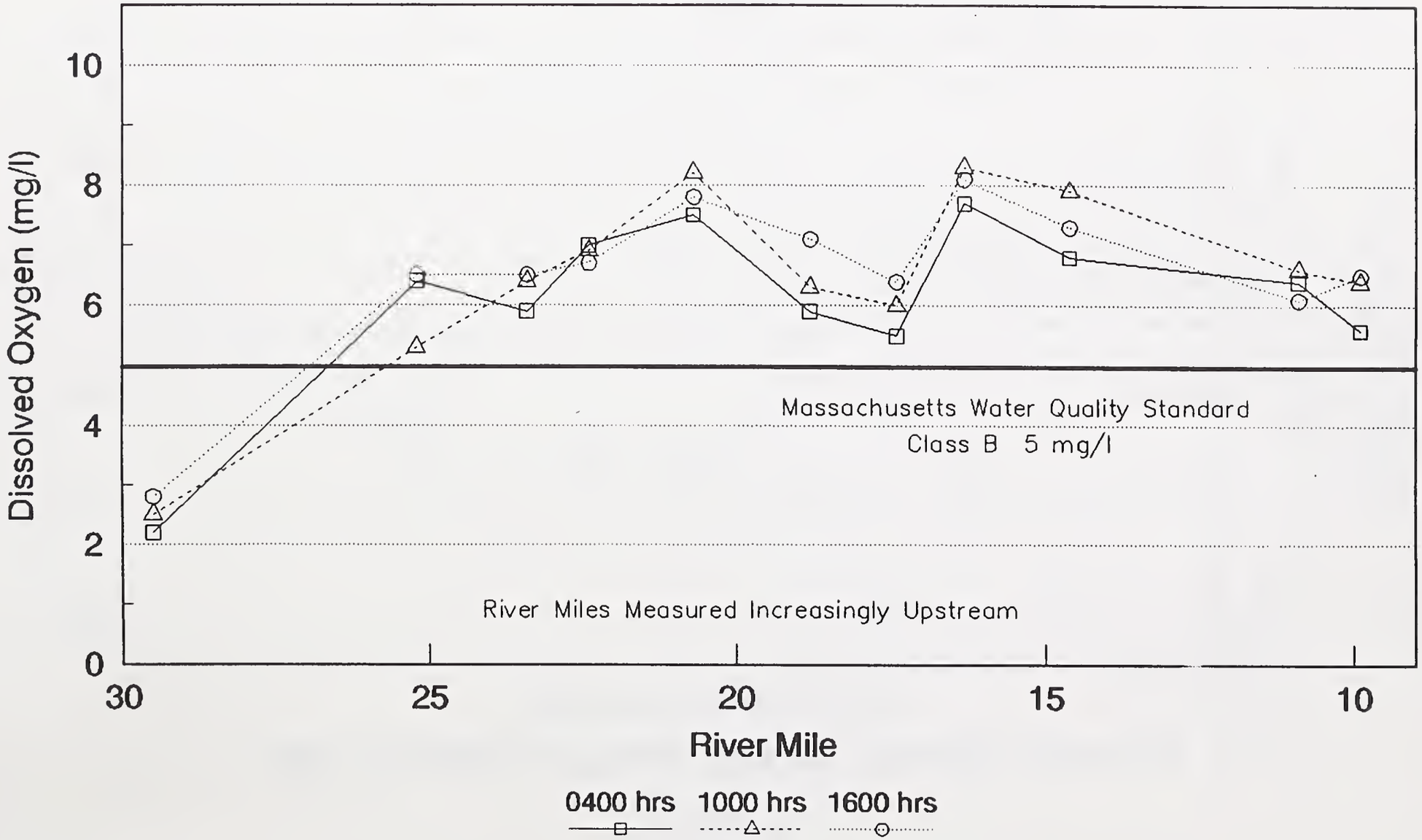


Figure 5

1991 Sudbury River Water Quality Survey

Percent Saturation Dissolved Oxygen 8/8/91

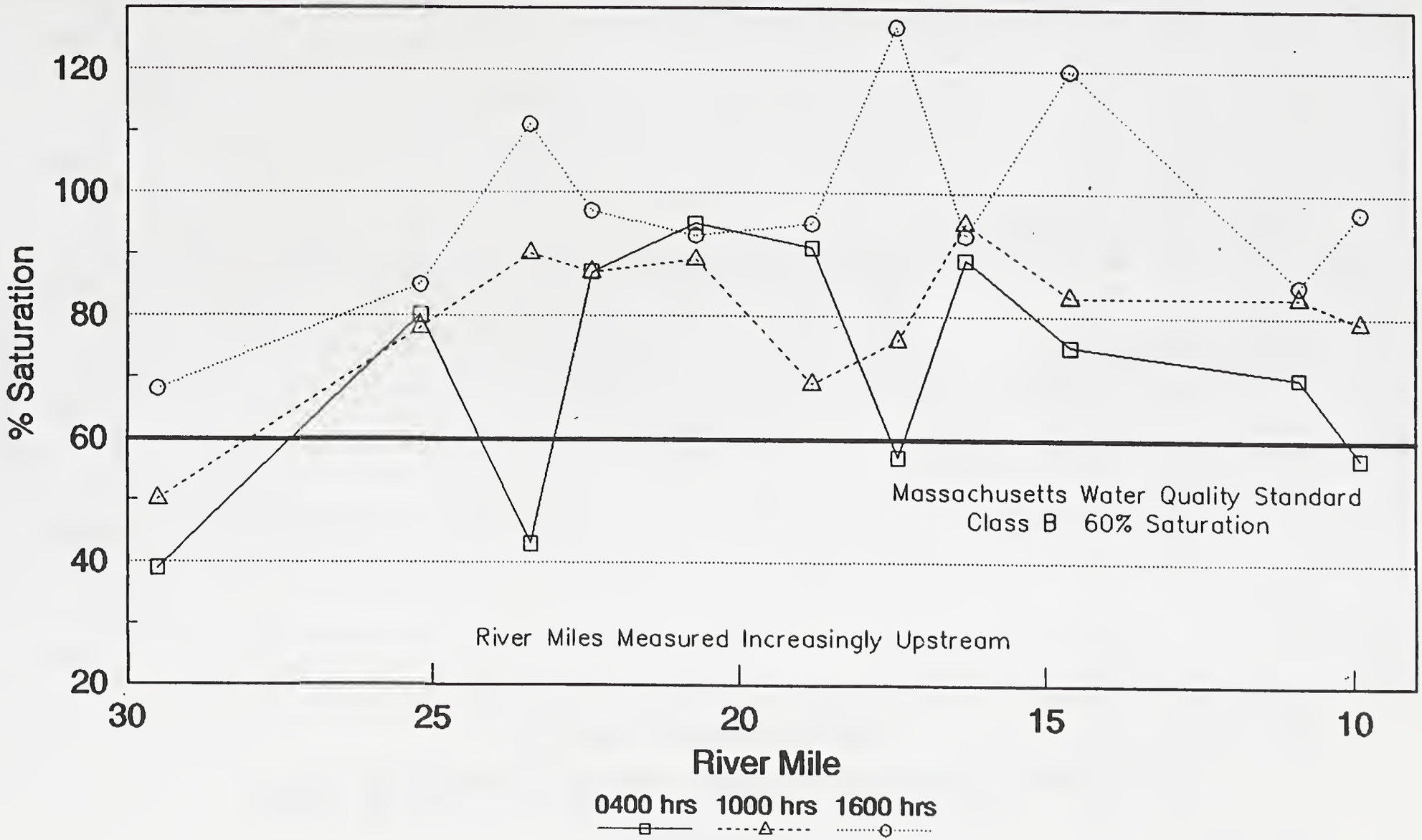
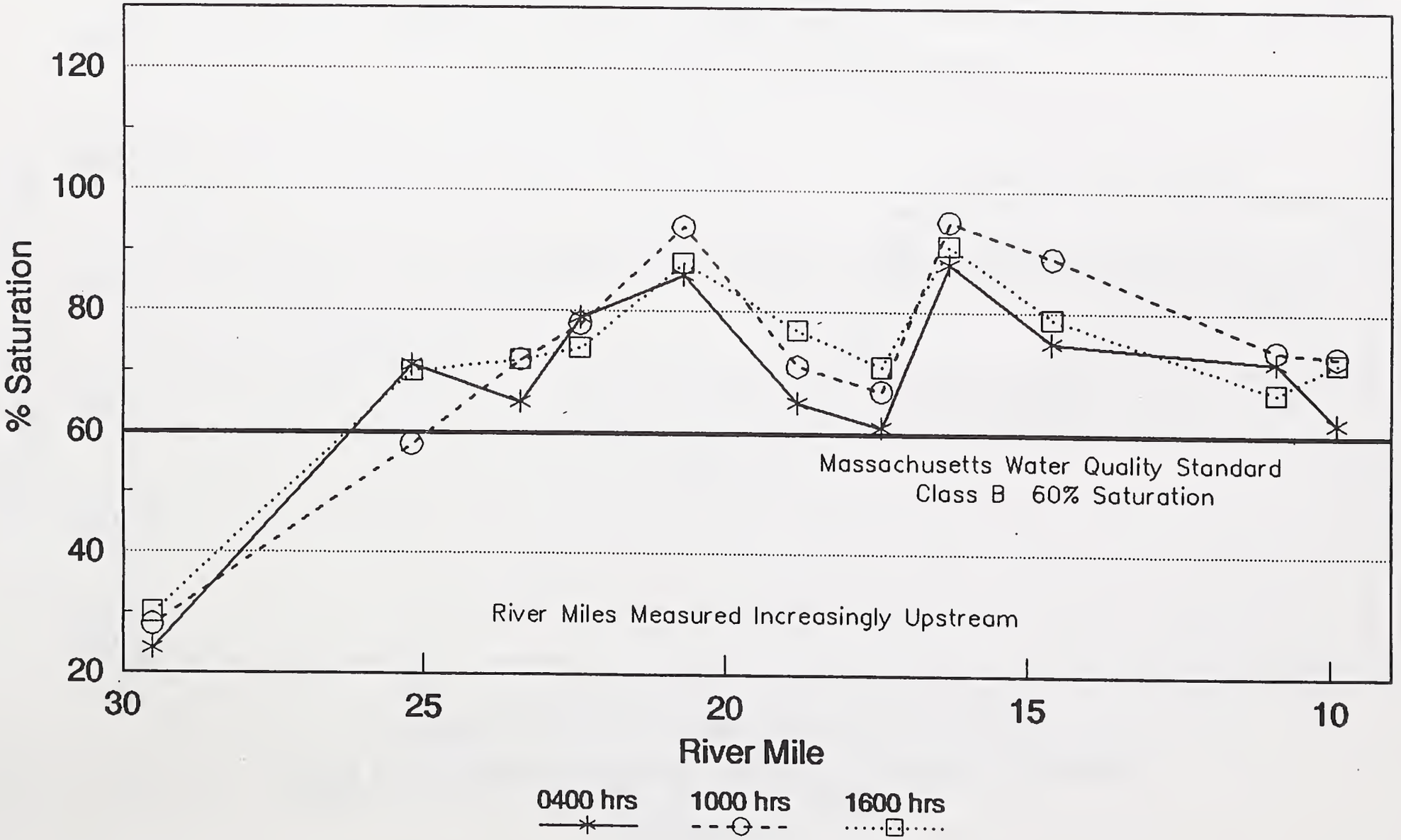


Figure 6

1991 Sudbury River Water Quality Survey

Dissolved Oxygen 9/19/91



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